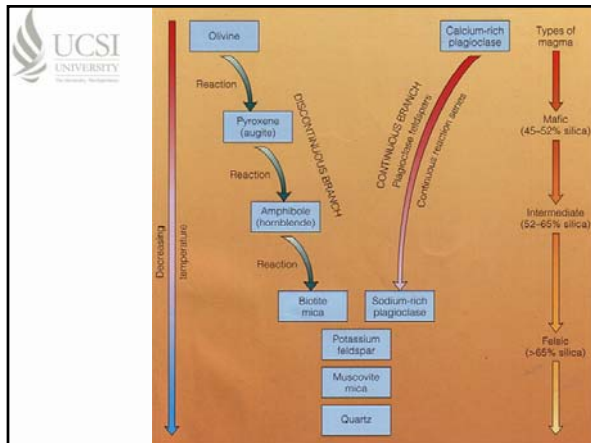




- Bowen's reaction series consist of continues and discontinues series.
- The discontinues series will form the ferromagnesian mineral, which after the mineral formed, each of them will be react again with the residual liquid to form mineral from the next sequence.
- The continues series consist of transformation plagioclase feldspar crystal with the exchange of calcium (Ca) with Sodium (Na).

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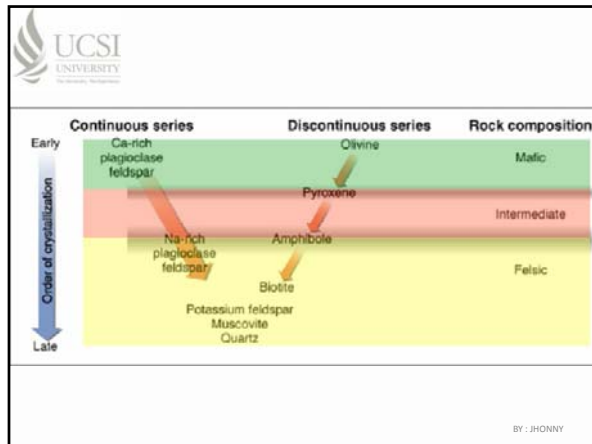


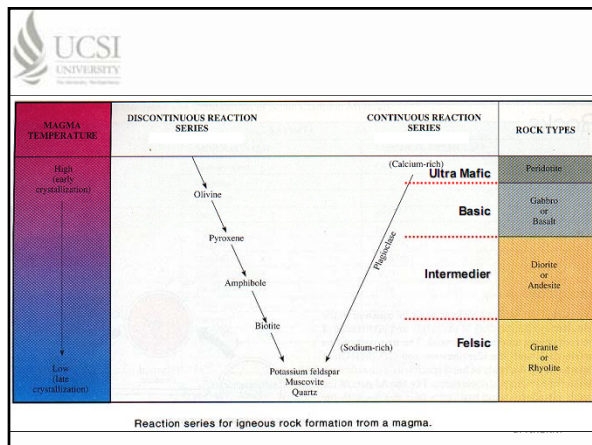


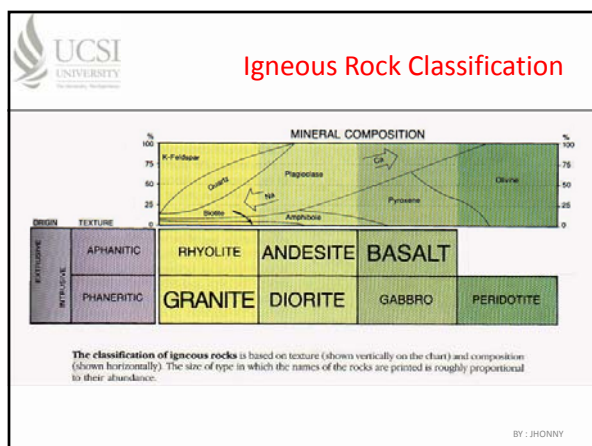
BOWEN'S CONTINUES SERIES (PLAGIOCLASE)

Plagioclase minerals and their compositions		
Name	% $\text{NaAlSi}_3\text{O}_8$ (%Ab)	% $\text{CaAl}_2\text{Si}_2\text{O}_8$ (%An)
Albite	100-90	0-10
Oligoclase	90-70	10-30
Andesine	70-50	30-50
Labradorite	50-30	50-70
Bytownite	30-10	70-90
Anorthite	10-0	90-100

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Relationship of Igneous Rock Types to Their Modes of Occurrence in the Earth's Crust.

	ROCK TYPE	SOME MODES OF OCCURRENCE
EXTRUSIVE	Pumice	Lava flows, pyroclastics
	Scoria	
	Obsidian	Lava flows
	Rhyolite Andesite Basalt	Lava flows, shallow intrusives
INTRUSIVE	Rhyolite porphyry Andesite porphyry Basalt porphyry	Dikes, sills, laccoliths, intruded at medium to shallow depths
	Granite Diorite Gabbro Peridotite	
		Batholiths and stocks of deep-seated intrusive origin

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Modification of Magma composition

- The magma composition can be change by few way. First it will form the ferromagnesian mineral which gravitate at the base of magma kitchen, reduced the Fe and Mg elements and enrich the other elements.
- Assimilation with the existing rock → at certain condition only.
- Magma mixing

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The atom structure and mineral

TETRAHEDRAL

The six major types of silicate structures are

1. nesosilicates
2. sorosilicates
3. cyclosilicates
4. inosilicates
5. phyllosilicates
6. tectosilicates

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TABLE EN2.2-1

Group	Schematic Arrangement of Silica Tetrahedra	Unit Composition and silicon: oxygen ratio	Example mineral and formula
Nesosilicates Isolated tetrahedra bonded to positive ions. There is no sharing of oxygen ions between tetrahedra.		$[\text{SiO}_4]^{4-}$ 1:4	Olivine $(\text{Mg,Fe})_2\text{SiO}_4$
Sorosilicates Two silica tetrahedra linked with one shared oxygen ion. Other positive ions bond to remaining oxygen ions at unshared tetrahedra corners.		$[\text{Si}_2\text{O}_7]^{6-}$ 2:7	Epidote $\text{Ca}_2(\text{Fe,Al})_2\text{Al}_2\text{O}_{10}(\text{SiO}_3)_2(\text{Si}_2\text{O}_7)(\text{OH})$
Cyclosilicates Three or more silica tetrahedra linked into closed rings. Each tetrahedron shares oxygen ions with two adjacent tetrahedra. Other positive ions bond to unshared oxygen ions.		$[\text{Si}_3\text{O}_9]^{12-}$ Si_3O_9	Beryl $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$

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Inosilicates Infinitely linked tetrahedra forming single or double chains. In single chains two oxygen ions from each silica tetrahedra are shared. Double chains are two single chains linked to each other where either 2-3 oxygen ions of each silica tetrahedron are shared. Other positive ions bond to unshared oxygen ions to link the chains together. The hydroxyl ion (OH^-), fits loosely in the openings between the two tetrahedral chains.		$[\text{SiO}_3]^{2-}$ 1:3	Pyroxene MgSiO_3
		$[\text{Si}_4\text{O}_{11}]^{6-}$ 4:11	Amphibole $(\text{Ca,Na})_{2-3}(\text{Mg,Fe,Al})_5\text{Si}_4\text{O}_{22}(\text{OH})_2$

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Phyllosilicates Also known as sheet silicates. The three oxygen ions at the base of the silica tetrahedra are all shared, producing infinitely flat sheet in two dimensions. Other positive ions bond to unshared oxygen ions.		$[\text{Si}_2\text{O}_5]^{2-}$ 2:5	Muscovite $\text{KAl}_3(\text{AlSi}_3\text{O}_{10})(\text{OH})_2$
Tectosilicates Also known as the framework silicates. All four oxygen ions of the silica tetrahedra are shared to form a three-dimensional framework. Other positive ions bond to the structure to balance charges that result from Al^{3+} substitution for Si^{4+} .		SiO_2 1:2	Quartz SiO_2

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NESOSILICATE / granular

olivine



BY : JHONNY





NESOSILICATE / granular

OLIVINE

Olivine crystals, such as this one, are the most common of all silicate minerals. They are green to black, with a glassy luster, and a granular texture. They are found in igneous rocks, and are the primary mineral in the mantle of the Earth.

PROPERTIES

Crystal System: Orthorhombic

Crystal Habit: Prismatic, tabular, or granular

Color: Green to black

Streak: Green to black

Luster: Glassy

Transparency: Transparent to opaque

Hardness: 6.5 to 7

Specific Gravity: 3.2 to 4.4

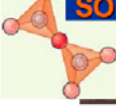
USING ZIRCON TO DATE ROCKS

Zircon is a very hard, durable mineral that is found in many types of rocks. It is used to date rocks because it is very resistant to weathering and erosion. The age of a rock can be determined by measuring the ratio of zircon to other minerals in the rock.



BY : JHONNY





SOROSILICATE (Short prismatic)

EPIDOTE

EPIDOTE FORMS COLUMNAR prisms or thin, wedge-shaped crystals with short prisms parallel to the crystal's length. It derives its name from the Greek word "epidote" because one side of the prism is always longer than the others.

A calcium aluminum iron silicate (FeAl₂Si₂O₁₀).

Hydroxide epidote can also be a colorless, colorless, and granular. This mineral is more easily recognized by its characteristic color—light to dark prismatic prisms. Pleochroism (the appearance of different colors when viewed from different directions) is strong. Epidote is a bright green chromite-like variety. Epidote occurs widely in low-grade regionally metamorphosed rocks, and as a product of hydrothermal alteration of igneous rocks.

epidote from Epidote (Gard) crystals are found in Canada, Mexico, Myanmar, Norway, Peru, and Colorado and California. Good-quality crystals are found in Australia and Pakistan.



PROPERTIES

Crystal System: Monoclinic

Crystal Habit: Prismatic, tabular, or granular

Color: Green to black

Streak: Green to black

Luster: Glassy

Transparency: Transparent to opaque

Hardness: 6.5 to 7

Specific Gravity: 3.2 to 4.4

USING ZIRCON TO DATE ROCKS

Zircon is a very hard, durable mineral that is found in many types of rocks. It is used to date rocks because it is very resistant to weathering and erosion. The age of a rock can be determined by measuring the ratio of zircon to other minerals in the rock.